FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 87 Thursday, November 17, 1949 No. 1733

49, Wellington Street, London, W.C.2

Grams: "Zacatecas, Rand, London"

'Phone: Temple Bar 3951 (Private Branch Exchange)

PUBLISHED WEEKLY: 26s. per annum (Home and Overseas)

Progress in Equipment

We have in recent times inspected two British works devoted to the production of foundry plant and we intend to visit others in the near future. We have every reason to believe that the excellent impression we have received from our visits is typical of this much-expanded industry. When one recollects the earlier "Foundry Exhibitions," the plant shown was largely of Continental origin or British made under licence from America. Whilst this latter phase still exists and, it must be emphasised, to the great benefit of this country, there has grown up here since about 1937 a foundry-equipment industry of considerable magnitude. The growth has been both vertical and horizontal. By vertical we mean expansion of manufacturing operations, as can be shown by the fact that, during the period under review, at least two firms—and there may be others—now employ some three hundred workpeople as against thirty to fifty in pre-war days. The horizontal expansion is the great contribution that has been made to the mechanisation of the industry by large manufacturers of conveyors.

Many millions of pounds have been invested by the foundry industry in new plant during the last decade, and the "know-how" thus obtained by the foundry-equipment firms is being put to the best advantage. When a foundry decides to mechanise its production, it should no longer be a mechanical gamble, for data are available from the hundreds of installations now in commission. We have inserted the word "mechanical" because all the foundry-equipment engineers can do is to guarantee quantity—quality of castings is still, and always will be, the concern of the foundry. By and large, a pleasing feature of the British-made plant is the virtue of being essentially robust—a factor not always present in pre-war imports.

The position to-day is that the foundry industry has a wide choice of excellent plant, some carrying major innovations of British origin. Though foundry-equipment manufacturers have expanded out of all recognition, they are not yet in a position, for most lines, to serve customers "off the peg." This is because most of the larger concerns are doing an extremely high percentage of export business which must take preference. Only last week, important executives left this country for Poland and India, whilst in the near future others are to visit South Africa and the U.S.A. This last peregrination is for the purpose of selling new types of British plant. If this succeeds, it will indeed be a reversal of the accepted order of things. Except for North America, where only a trickle has entered, British foundry plant has been sold all over the world and we congratulate this ever-expanding industry on the great progress it has registered during the last decade and, moreover, under quite difficult conditions.

Contents

Progress in Equipment, 591.—October Steel Output Record, 592.—British Standards Institution, 592.—S. Rhodesia Steel-coal Talks in London, 592.—Forthcoming Events, 592.—Correspondence, 592.—Making a Large Multi-cylinder Diesel Crankcase, 593.—Factors Controlling the Hot Tearing of Aluminium Alloys; Examples of Aluminium-alloy Foundry Practice; Some Notable Aluminium-alloy Castings, 602.—Melting Techniques for Aluminium Alloys, 605.—News in Brief, 608.—Buyers' Market for European Steel, 608.—Grey-iron Jobbing Founders to Visit U.S.A., 608.—B.C.I.R.A. Annual General Meeting, 609.—Pig-iron and Steel Production, 612.—A New Australian Foundry Journal, 613.—West German Steel Scrap for U.K., 613.—Steel Company of Wales Project, 613.—Company News, 614.—Company Results, 614.—Obituary, 616.—Increases of Capital, 616.—Scottish Foundryman Honoured, 616.—Correspondence, 616.—Raw Material Markets, 618.

D

October Steel Output Record

Steel production in October was at an annual rate of 15,959,000 tons, which compares with the previous best rate in October of 15,455,000 tons, which was achieved last year. Output in September last was 15,906,000 tons. Total steel output in the first 10 months of this year was 12,814,000 tons, against 12,253,000 tons in the corresponding period of last year.

October pig-iron production was at an annual rate of 9,565,000 tons, as compared with 9,525,000 tons in the same month of last year.

Latest steel and pig-iron output figures (in tons) compare as follow with earlier returns:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1949—1st quarter ..	179,300	9,324,000	304,800	15,850,000
2nd quarter ..	183,800	9,559,000	306,600	15,944,000
3rd quarter ..	181,700	9,448,000	279,000	14,552,000
October ..	183,900	9,565,000	306,900	15,959,000
1948—1st quarter ..	174,700	9,084,000	287,200	14,933,000
2nd quarter ..	182,000	9,464,000	294,700	15,325,000
3rd quarter ..	175,800	9,143,000	269,200	13,998,000
October ..	183,200	9,525,000	297,200	15,455,000

British Standards Institution

The British Standards Institution has recently published the following additional parts to B.S.1121, Methods for the analysis of iron and steel; Part 12:1949, Silicon in acid-resisting high-silicon iron; Part 13:1949, Chromium in iron and steel, and Part 14:1949, Copper in carbon steels and low-alloy steels. Solutions required, test procedure and calculations are specified for each method.

Another recent publication of interest to founders is British Standard 1591, Acid-resisting high-silicon iron castings. This covers the requirements of this material for chemical-engineering purposes. The chemical composition of the castings and the procedure for chemical analysis are specified. Details are also provided relating to heat-treatment, freedom from defects, porosity, repairs to castings, welding, marking and packing, inspection and testing facilities.

Copies of the parts of B.S.1121 are 1s. each, post free, and B.S.1591 costs 2s., post free, from the British Standards Institution, Sales Department, 24, Victoria Street, London, S.W.1.

New I.B.F. Sub-committee

At the recent meeting of the Technical Council of the Institute of British Foundrymen, a new sub-committee was formed, with the following terms of reference:—

"To explore the suitability of the pyrometric and alternative methods for investigating the rate of solidification of cast iron."

The sub-committee is designated as T.S.33 and is under the chairmanship of Mr. L. W. Bolton.

Forthcoming Events

NOVEMBER 21.

Sheffield Society of Engineers and Metallurgists.

"The Aerodynamic Aspects of Open-hearth Furnace Design," by J. H. Chesters, Ph.D., D.Sc.Tech., at the Royal Victoria Station Hotel, Sheffield, at 6.15 p.m.

Institution of Production Engineers.

North-Eastern Section:—"The Human Factor in Productivity," by Dr. Jacques, at the Neville Hall Mining Institution, Westgate Road, Newcastle-upon-Tyne, 1, at 7 p.m.

NOVEMBER 22.

Halifax Graduate Section:—"The Production of Steel and Bronze Castings for Engineering Purposes," by G. L. Hancock, at the Huddersfield Technical College, at 7 p.m.

Institution of Chemical Engineers.

Chemical Engineering Group:—"Submerged Flame Combustion," by N. Swindin, at the Geological Society, Burlington House, London, W.1, at 5.30 p.m.

NOVEMBER 23.

Institute of British Foundrymen.

Birmingham Branch:—"The Production of Pig-iron for the Foundry Trade," by N. Gray and W. E. Simons, at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7 p.m.

Institution of Production Engineers.

Birmingham Graduate Section:—Visit to B.S.A. Tools, Limited, Birmingham.

Institute of Physics

London and Home Counties Branch:—"Physics of Atmospheric Pollution," by Dr. A. R. Meetham, at the Royal Institution, Albemarle Street, London, W.1, at 5 p.m.

NOVEMBER 24.

Institute of British Foundrymen.

Scottish Branch:—"Modern Light Castings Production," by R. S. M. Jeffrey, B.Sc., F.R.I.C., at the University College, Dundee, at 7.30 p.m.

Institute of Industrial Supervisors.

London Central Section:—Films: "Wheels Behind the Wheels" and "Industrial Handling," at the Polytechnic, Regent Street, London, W.1, at 7.30 p.m.

NOVEMBER 25.

Institute of British Foundrymen.

Falkirk Section:—"Work in a Jobbing Foundry," by J. F. Dowell and H. London, at the Temperance Café, Lint Riggs, Falkirk, at 7 p.m.

NOVEMBER 25 and 26.

Institute of Physics.

X-ray Analysis Group:—Conference at Leamington Spa.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

MELTING EQUIPMENT

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—May I thank Mr. Golby for pointing out the error in the figures given in my previous article.* I think he would agree that those printed for oil consumption would be regarded as uneconomical for almost any melting furnace. The oil consumption should have been for 1,000 lbs. of metal and not 100 lbs. as printed.

The high efficiency of Sklenar furnaces is well known to me and I trust that no reflection was cast on their performance in the minds of readers by this omission.—Yours, etc.,

A. W. BRACE.

13, Kelling Gardens,
Croydon, Surrey.
November 15, 1949.

*Correspondence printed in our November 10 issue.

Making a Large Multi-cylinder Diesel Crankcase*

By J. F. Barnes and F. E. Ironmonger

(Continued from page 570)

PART II—MOULDING

By F. E. Ironmonger

Notification that the pattern is ready for production is the sign for activity in the foundry. Space, plates, etc., have to be prepared for immediate use. As will be seen later, the box, the dimensions of which are 22 ft. by 10 ft. by 3 ft. 6 in. for each half, takes up a considerable amount of floor space. Rolling-over space has to be made, as well as space for final coring, closing and casting, so it will be seen how necessary it is to have everything ready for the pattern to be in the shop the moment preparations have been made for its reception. After space has been prepared, two machined plates are put on the floor, care being taken to see that they are level; a spirit level is used for this purpose.

The following is the method of moulding, coring and casting:—The pattern is sent from the pattern shop on a flat trailer and lifted off by crane, using four lifting straps, evenly spaced to prevent, as far as possible, any distortion during transit from one place to another. The bottom half of the pattern is put on the two plates and a check is taken to ensure that all loose pieces are in their respective places and that ingates are securely fastened, as shown in Fig. 13. The box part is next put over the pattern (Fig. 14), and fastened to the plates by means of nuts and bolts. Care is taken at this point to set the pattern so as to give the correct location for feeders, risers, etc., when the top half is being rammed up. Part of the down-sticks are put in at this stage to connect with the pound situated in the core; this will be further explained at a later stage when coring-up is described.

Ramming the Mould

Ramming now starts, and facing sand is used to the top of the core prints, seen on the top face of the pattern. This sand is milled in a Simpson batch mill and brought to the floor in tipping skips by means of an overhead mono-rail telpher which runs the whole length of the shop. During ramming, grids and other reinforcements are used at the sides and ends to give

* A Paper presented to the Lincoln Section of the East Midlands Branch of the Institute of British Foundrymen. It was announced at the June Conference that the Authors of this Paper had been awarded a Diploma. The first section mainly concerned Core-making, and was presented by Mr. J. F. Barnes.

FIG. 13.—PATTERN, WITH LOOSE PIECES ASSEMBLED, SET ON PLATES ON THE FLOOR OF THE FOUNDRY.

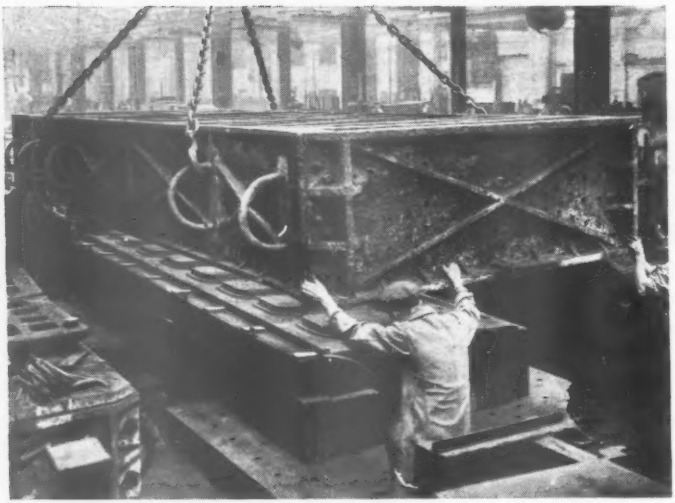

FIG. 14.—PLACING THE BOX PART OVER THE PATTERN.

the extra security necessary for holding the sand firmly in place after the pattern has been withdrawn and to act as a buffer against strain during casting. The reinforcements used are straight pieces of iron or steel, criss-crossed the whole depth of the pattern, or level with the face of the core prints. When the ramming has reached this point, bricks are used between each window and box bar and securely wedged by means of 2 in. by 2 in. packing pieces and brass wedges. This makes a firm bed for cores, and also helps to prevent sagging during the taking in and out of stoves and during drying.

Ramming then continues up to the top of the bricks (Fig. 15), and the whole of the mould is then thoroughly vented all over. At this point of ramming, grids are put on top of the sand and tapped firmly in. These cover the whole area of the box, and are themselves covered with sand and re-vented. A coke bed is next put on, the depth of which is 2 to 3 in. and just over 4 in. from the top of core prints. The

FIG. 15.—RAMMING COMPLETED TO THE TOPS OF THE CORE PRINTS.

FIG. 16.—COKE BED ARRANGED ABOVE THE CORE PRINTS.

coke bed (Fig. 16) is in contact with a number of holes in the sides and ends of the box to give an easy escape for gases generated during casting operations. It may be of interest to state that all the large boxes have cored holes in the sides and ends. The remainder of the box is now rammed up; backing sand is used for this purpose and is prepared by mixing and cleaning the tempered floor sand through a Royer sand thrower. The whole of the backing-sand layer is vented to the coke bed. A 3-in. grid is put on top and fastened to the box part by means of nuts and bolts and is rammed up between the bars to the top. Although 3-in. box bars are used, this grid is an extra safeguard which has been found necessary in castings of this size and class in order to prevent strain.

Turning Over

The whole is now ready for turning over. This is a major operation; two cranes are used and the departmental foreman takes control, the crane drivers

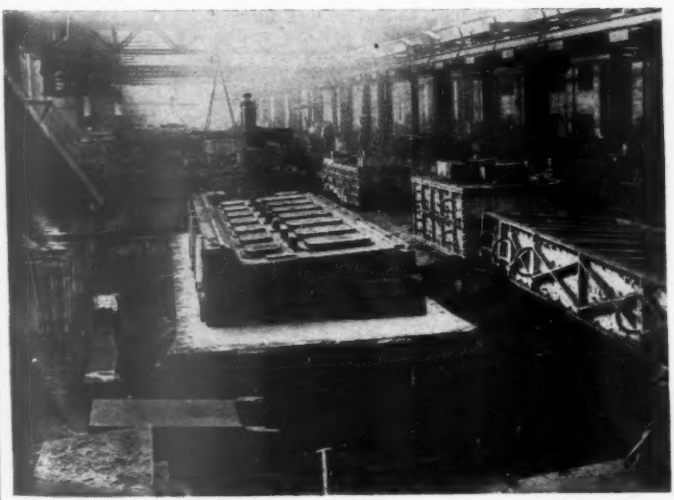

FIG. 17.—TOP-HALF OF THE PATTERN IN POSITION.

Multi-cylinder Diesel Crankcase

taking no notice of anyone else. Short chains are used, as the distance or clearance between crane and the box when on its side is small. Hard wooden blocks are used, slightly deeper than the box handles, to protect them during the rolling-over operations and also to guard against slipping or slewing. When this has been done, the box is put on a firm and level bed, making sure that floor space is available to accommodate top and bottom halves when splitting the top from the bottom. When the whole is finished rammed-up, the plates are taken off and placed conveniently, to be used as a core-storage depot for the cores, which are so numerous and for which storage space is limited.

FIG. 18.—LOWERING THE TOP HALF. NOTE THE EXTENDED PIN LENGTH FOR EARLY LOCATION.

Ramming the Top Part

The top part or cope is now proceeded with by placing the top half of the pattern on the part already rammed-up (Fig. 17), care being taken to see that the dowels engage perfectly in the dowel holes in the bottom half of the pattern. Parting sand is sprinkled on the joint to ensure a clean parting after the whole is rammed-up. The box part is put on, location being

FIG. 19.—ROLLING-OVER OPERATION.

made by means of a pin at each end of the box. The pin size is 2½ in. dia., with a slight taper from the point of the pin to about 4 in. from the shank to give a free and easy passage of the pins during closing.

The outside joint of the box is chalked and marked at several points to make sure there is no twist or staggering when trying-on and finally closing just before casting. The pins, too, are slightly longer than the half-pattern, so that the pins during closing enter the pinholes of the bottom half before the cores enter the mould,

FIG. 20.—BOTTOM-HALF MOULD BEING PREPARED FOR DRYING.

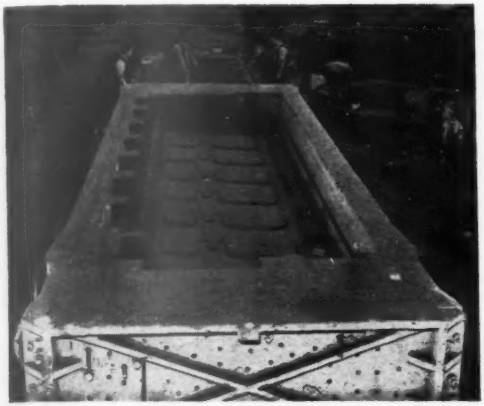

FIG. 21.—TOP-HALF MOULD BLACKED AND READY FOR DRYING.

thus avoiding a possible crush at ends or sides when lowering over cores during this stage (Fig. 18). Downsticks are put in place adjacent to the two already in the bottom half. Grids with prods are fastened to the inside of the box, as an extra precaution for keeping a compact and closely-knitted sand, which thus has little or no chance of breaking away when the box has been rammed-up and the pattern taken out. They are used, also, to hang lifters on during the ramming. Facing sand is riddled on the joint area of the mould and lifters are put in, making sure that all springiness is taken out by ramming firmly and also making sure that each lifter is hung firmly on a prod from the grids.

Ramming proper now commences, facing sand being used as for the bottom half. As well as grids and lifters, straight irons are also rammed-up at the sides and ends of the box during this operation. When the ramming has reached just below the top part of the liner core prints, the feeder-head patterns are put into position, slightly to the side of the prints, so that eventually this metal will feed the extra-thick sections at that point. It should be noted here that thick sections are fed whenever they are accessible. Where they are not accessible for feeders, chills and, possibly, denseners have to be used. Ramming of the whole then continues to the top of the pattern. Hook screws are put into the four lifting straps, to be fastened later to the top of the grid, which has to be put on, to prevent any movement of the pattern during splitting and rolling over. Lifters are put in the whole area of the pattern, care being taken to keep the foot of the lifters clear of the pattern, but they are firmly rammed to help to prevent springiness. There is nothing more annoying to a moulder than to find, when the pattern has been taken out, that several of the lifters have sprung through the face of the mould through neglect. More sand is riddled on and window prints are packed to the bars with bricks, as in the bottom half. Downsticks for the top runners are put in at this point, as are also the feeders on the flange and the risers—at least one on each of the window facings. The top is then completed with backing sand, which, like that used in the bottom half, has been cleaned and mixed by using a Royer sand thrower. Grids, duplicates of those used on the bottom, are placed on and fastened to the box by means of nuts and bolts and then rammed between bars to the top. Downsticks, feeders and risers are taken out and the hook screws are fastened to the top of the grid by means of fishplates and nuts. The box is now ready for parting, two cranes being used and the departmental foreman again taking full control. After

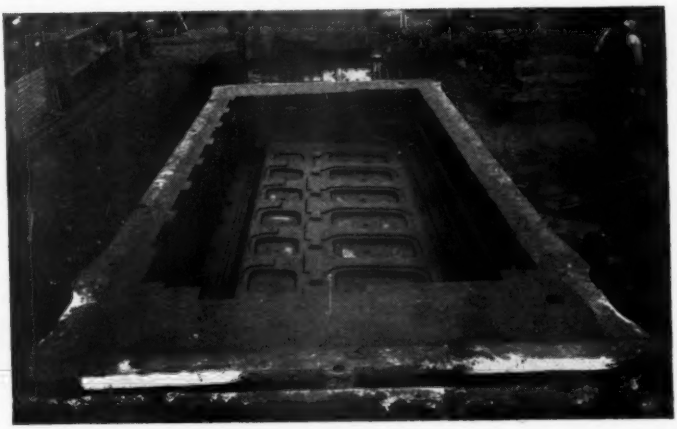

FIG. 22.—TOP-HALF OF THE MOULD AFTER CORING-UP, RE-BLACKING AND RE-DRYING.

FIG. 23.—SETTING THE MUD-HOLE CORES.

rolling-over, the top part is prepared first. The screw hooks are taken out, followed by the pattern; the mould is then well sprigged, loose pieces are taken out, repairs are made, blacking is applied, and the whole made ready for drying (Figs. 19 and 20). One point of interest is the practice of drying each half-mould in a drying stove instead of drying on site, as is often common practice for large work of this description. The top part is being dried while the bottom half is being prepared for stoving (Fig. 21).

Coring-up

The top-half of the mould is cored-up first. This is done while the bottom half is in the stove. Window cores are first inserted. These are fastened to the top by hook screws, fishplates and nuts. There are seventeen of these, eight over the jacket cores, eight over the crankcase cores and one over the timing cores. The cores producing the oil tray come next, they cover the whole length of the mould; besides forming the oil tray they carry the prints for liner, or barrel cores, and produce half the cylinder-head face of the casting. These cores are fastened to the side of the box by means of hook screws through holes in the side of the box, fastened by fishplates and nuts. To make sure that no movement takes place they are also fastened to the top grid by the same means. Various other small cores are spiked in, then the whole of this part of the mould is again blacked and dried by a pressure paraffin torch (Fig. 22). It is now ready for rolling over and a special clamp is brought into use to help to keep the box rigid during this operation. After this has been done the box is put on stands, high enough to allow the moulder to get underneath to do any necessary repairs and to ensure that risers, etc., are clean from top to bottom. Runner bushes, riser pots and feed pots are put on and then the whole of the gang concentrates on getting the bottom part ready.

The bottom part is, of course, more involved than the top part. A pit about 12 in. deep has to be got ready, into which are placed two beams, to be used later as a clamping device. The box is brought from the drying stove and put into the pit, great care being taken to have it level. Coke is rammed between the box and the side of the pit to connect with the coke bed in the box (already referred to in the section on moulding), which gives an easy passage for escaping gases from the mould and cores during and after casting. Cores are brought to the mould by means of a crane and inserted in rotation. These have to be accurately located in position by means of wooden templates to ensure correct thickness of metal, and the relation of one core with the other as they are put in their respective places.

The window cores are put in first; these are checked for height and this is the start of core setting proper. Each has a male print which engages in a female print in the bottom half of the jacket cores. The cylinder-head face-cores are next inserted; these are printed on the bottom of the mould and fastened to the side of the box by hookscrews, fishplates and nuts, using holes in the side of the box. These cores also produce a cavity for the camshaft and carry prints for the barrel cores. The bottom-half and the jacket cores are then placed in position; these fit on top of the window cores and engage on the prints of the window cores. There are four of these, each section big enough to make two cylinders; they are interlocked one into another, starting at one end of the mould, and checked to correct metal thickness.

The timing cores are set in at this stage and are kept in position by a good print at the bottom and side of the mould. Again templates are used for thickness and care taken to see that the core is in an upright position

FIG. 24.—FITTING THE CRANKCASE TOP-HALF CORES.

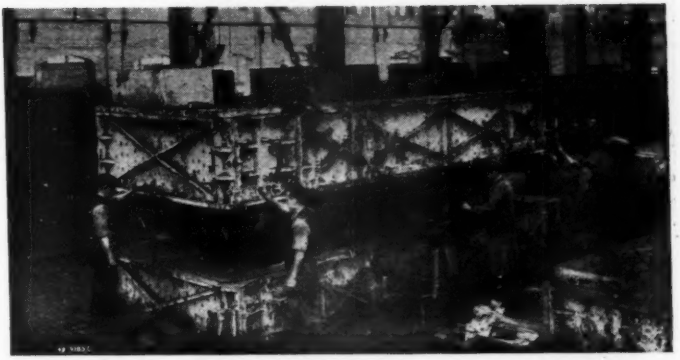

FIG. 25.—TRIAL CLOSING OF THE MOULD.

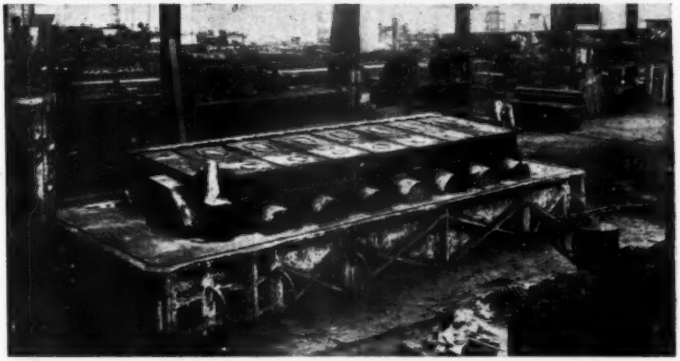

FIG. 26.—MOULD BEFORE FINAL CLOSING. NOTE THE "CLAY" SEALING AROUND VENT HOLES AND EDGES.

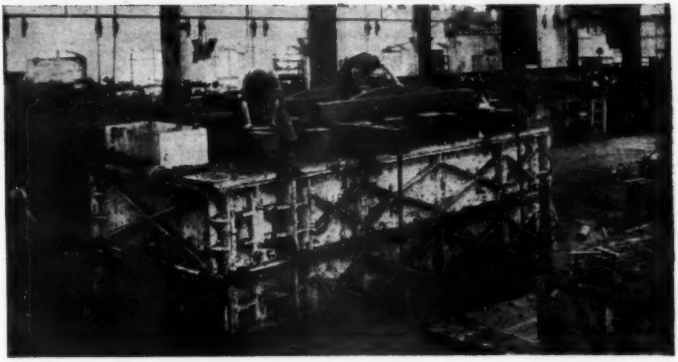

FIG. 27.—FINAL CLAMPING AND WEIGHTING OF THE MOULD.

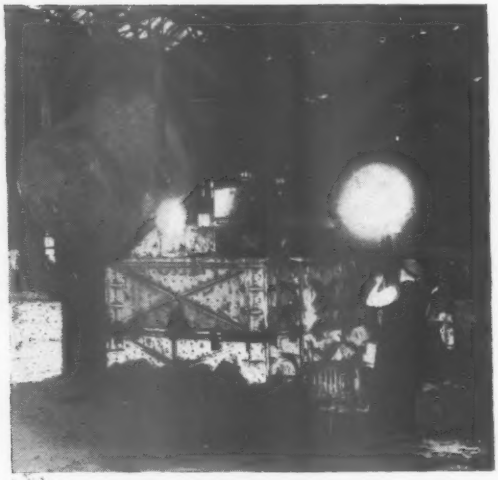

FIG. 28.—CASTING OPERATION; THE SMALLER LADLE IS MASKED BY THE GLARE OF THE MOLTEN METAL.

throughout its length. The crankcase cores are next to be set; these are divided on account of the weight and the small end is set first. Incorporated in this section is the pound to connect the ingates, already referred to, in the bottom of the mould. The larger sections of the core are then set; these, of necessity, being made singly. They house one end of the barrel core.

Careful templating is essential at this juncture, as the accuracy of the whole of the liner bores depends on this setting for alignment with the cylinder-head face-cores. Mud-hole cores are next set, there are sixteen of these, eight for the bottom and eight for the top. They are put into prints in the bottom of the mould and studded to hold them in position between the jacket cores and the crankcase cores (Fig. 23). The barrel- or liner-cores are now put in, great care being taken that no play is allowed, as the thickness of metal is so very important. Studs are used between jacket and barrel cores to prevent any lift that is likely to occur while casting and to maintain thickness of metal. After the whole of the barrel cores are in the top half of the jacket, these cores are mated with the bottom-half cores which cover the barrels. The mudhole cores are put in in the opposite way to the ones in the bottom, to have the smaller section nearest the outside of the casting.

The crankcase top-half cores are also put on the bottom half, making sure that the fitting on the barrel print is accurate (Fig. 24). The extension cores of the crankcase are the last cores in, these produce a section for bolting-down to the bedplate. The mould is then ready for closing. Rolled damp clay is used at the ends, sides, top and at any other point necessary to see that thickness of metal has been maintained, for, although templates are used and great care is taken up to this point, it is essential that the thickness of metal on the top is in relative agreement with the other sections. In other words, the shrinkage of cores or mould has to be taken into account, all through the operations. Rags are used to fill in all spaces until after

FIG. 29.—STRIPPING THE CASTING FROM THE MOULD.

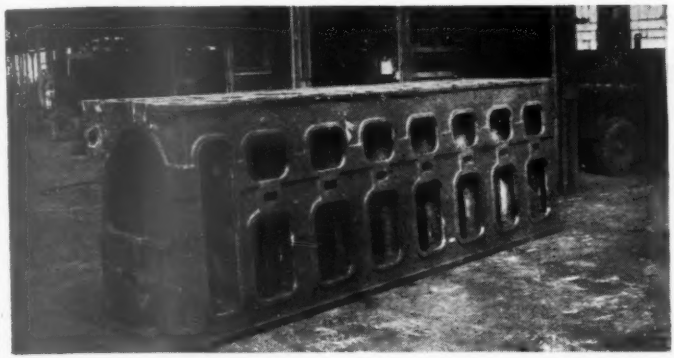

FIG. 30.—THE FINISHED CRANKCASE CASTING.

the try-on to prevent any bits of sand falling to the bottom of the mould in the case of a "crush." The top half of the box is lowered on to the bottom half and clamped so that a true picture can be seen when the mould is split again (Fig. 25). The clamps are knocked off, the top half lifted off and the whole is well examined to see the thicknesses are correct and that no crush has taken place. If everything is found correct, the clays and rags are taken out. Thin layers of clay are put around each vent hole and each edge of the box ready for final closing, in order to form a seal (Fig. 26). The top is again lowered for the last time, clamped-up and the joints rammed-in thoroughly with loam. Two beams are put on top between the bushes and screwed to the two beams at the bottom of the mould, referred to earlier in the Paper. Other beams and weights are put on top to give a little extra security (Fig. 27). The housing is now ready for casting.

Pouring

Two ladles are used for pouring, of 15- and 7-ton capacity. To make allowances for the difference in ladle size, the bottom pound is divided into two sections from which five ingates for the 15-ton and three ingates for the 7-ton ladle are arranged. It takes, roughly, three hours from the start of continuous tapping from the cupola into the ladles to the actual casting (Fig. 28). After casting, the mould is left for about ten days, when the casting is taken out and de-cored on the floor at the end of the box (Fig. 29). It is then taken to the fettling shop for shot blasting and dressing. The finished casting is shown in Fig. 30, and Fig. 31 shows housing and bedplate castings together to give an idea of the size of the two, the combined weight being 27 tons.

It is hoped that this description has not given the impression that this is a complicated special job. In fact, it is a job that is in such regular production that it is now undertaken as a matter of regular routine. This coming year the foundry is scheduled to make one every four weeks, so it will be appreciated that work to such a programme has had to be made a routine job. The Authors warmly thank the directors and management of Ruston & Hornsby, Limited, for permission to publish this Paper and their colleagues for the help given in its preparation.

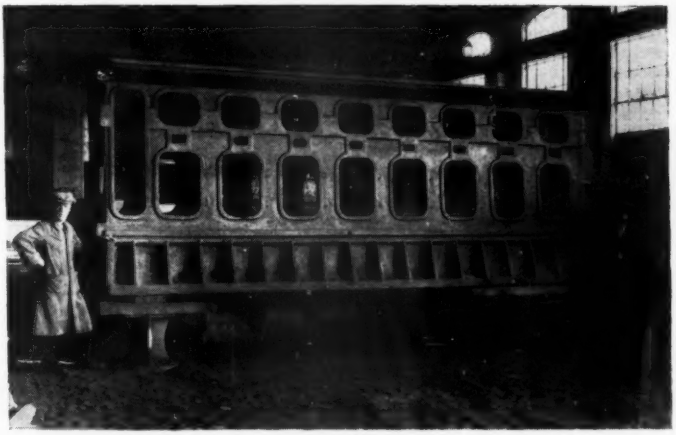

FIG. 31.—CRANKCASE CASTING MOUNTED ON ITS BEDPLATE, SHOWING THE MANNER OF THEIR FINAL ASSEMBLY.

Institute of British Foundrymen — *Cheltenham Conference Discussions*

Factors Controlling the Hot Tearing of Aluminium Alloys*

By D. C. G. Lees, M.A., A.I.M.

Examples of Aluminium-alloy Foundry Practice†

By J. Caven and H. W. Keeble, A.I.M.

Some Notable Aluminium-alloy Castings‡

By A. R. Martin, B.Sc., A.R.S.M.

When the three contributions on aluminium-foundry practice were presented at the Annual Conference of the Institute of British Foundrymen, at Cheltenham, it was agreed that the Papers had so much in common that there could well be held a joint discussion, the Authors forming a panel to answer questions.

THE CHAIRMAN (Mr. Colin Gresty), opening the discussion, said that all the Authors had obviously borne in mind the Institute's request for real practical Papers and a considerable amount of useful information had been given. He was very interested in what Mr. Lees had referred to as "self-healing properties." The term was new to him and he wondered if it was to be inferred that after the casting had self-healed it was as good as it would have been had it not needed any self-healing treatment? He wondered if there would be any danger of brittleness as an after effect?

MR. LEES replied that he did not think that a casting which had healed itself was as good as if self-healing had not been necessary. Self-healing was a piece of segregation which was never favoured. Mr. G. D. Chapman had shown that the bands due to self-healing were not removed by ordinary heat-treatment. Similar effects had been observed in steel castings.

MR. J. A. REYNOLDS referred to self-healing in connection with aluminium billets for wire-drawing and the difficulty of getting those which were not homogeneous to roll or draw satisfactorily. He also asked for information on what was the best type of wheel to use for surface grinding aluminium and if it was possible to overcome the effect of clogging.

MR. KEEBLE said he understood the questioner had a casting which he wanted to surface-grind instead of machine. There was no doubt that aluminium casting alloys, because of their being softer and more ductile than ferrous materials, would clog grinding wheels to a greater extent. Advice on wheel speeds, grit formation and feeds could be had on referring the matter to grinding-wheel manufacturers.

Following further discussion, MR. REYNOLDS said that it did not appear to be an economical proposition to grind aluminium.

MR. T. H. WEAVER said that his firm had had some experience of the problem and if Mr. Reynolds cared to approach him afterwards he would give him some practical information on the subject.

MR. LEES, referring to Mr. Martin's Paper, said he was not familiar with the alloy DTD. 272/276 and asked why it had been chosen for the manufacture of the cylinder head.

MR. MARTIN replied that the choice of alloy lay between "Y" alloy and the DTD. 272/276 alloy and the respective merits of the two alloys were set out in the introduction to the Paper. "Y" alloy—although the better of the two as regards high-temperature properties was not a straightforward alloy to handle in the foundry and was very hot short. A cylinder head of this description was not likely to be highly stressed at temperature. On the other hand, due to its complex design, a (comparatively) high pouring temperature was required and an alloy which possessed adequate properties at the working temperature and had good casting characteristics would be the better choice.

The alloy selected was widely used in the Author's foundry in the "as-cast" condition, solution heat-treated (DTD. 272) and when fully heat-treated (DTD. 276) for a variety of general-engineering applications and, given the stress-relieving heat-treatment, it was also suitable for cylinder-head service. The alloy was capable of covering such a wide range of applications that the Author regarded it as a very useful general-engineering material.

MR. A. W. BRACE asked for further clarification of Fig. 3, page 4 of the preprint of Mr. Lees' Paper, in regard to the temperature range which appeared to be longer in one case than for the other alloys. He further wondered whether the aluminium/silicon alloys used for the tests had been modified.

MR. LEES replied that he would like to thank his colleague Mr. Brace for drawing attention to what was a defect in his Paper. The three curves in Fig. 3 referred to measurements on castings which were allowed to solidify at different rates and on castings which were re-heated. In re-heating, there was time

*Printed in the JOURNAL, August 18. †June 23 and 30. ‡September 8 and 15, 1949.

for some diffusion of the silicon to take place and this was the reason why the curves were different. In his work and, he believed, also in the work done at Birmingham University, the aluminium/silicon alloys were all modified, but this probably had no effect on the resistance of the alloys to hot tearing.

MR. A. W. BRACE said he noted that in the production of the paraboloid casting the Authors stressed the importance of the modification condition of the 2.L.33 alloy. He would like to know whether the "salts" method or sodium treatment was applied. In this same casting, copper inserts were built-in to accelerate cooling at the large bosses. In the light of the thermal properties of aluminium and copper, he would like the Authors' views on the use of these materials for chills.

MR. KEEBLE said that metallic sodium was used for the modification treatment. Whether the "salts" or sodium method was used depended upon a multitude of factors which arose from the local conditions surrounding the production of a given casting. Concerning the use of aluminium and copper as chills in ordinary sand-foundry practice, there were occasions when aluminium-alloy chills were used, but, generally speaking, they were not used because of the ease with which the face of the chills were eroded by the flowing metal. Copper chills were not used, mainly because it was often more convenient, and certainly less expensive, to prepare chills in cast iron, and loss in chilling power was small where ordinary sections in sand moulds were concerned. In the paraboloid casting, copper inserts were used because the die was made in cast iron (heated to 200 deg. C.) and the extra cooling power of a copper rod was desired. Aluminium was not used for the reason already stated.

MR. G. L. BAILEY said he had been considering for some time which fundamental properties of an alloy determined its casting characteristics. The contribution of Mr. Lees was a discussion of one of the basic properties of alloys which controlled their suitability for making certain sorts of castings, but the tendency to hot cracking was only one of a number of such properties. Another, which was touched on by Mr. Lees, was fluidity. He thought fluidity was almost certainly closely related to the degree of superheat, and hot cracking was very well dealt with in the Paper which Mr. Lees presented. Mr. Lees had, he thought, been too modest about his own work and it was very satisfactory to see how well his more practical experiments compared with the later more fundamental study of the same subject at Birmingham University. One of the most important remaining problems seemed to be the different manner in which alloys distributed the shrinkage porosity which was, generally, unavoidable in ordinary castings. In some alloys, several per cent. of shrinkage voids could have relatively-little detrimental effect, while in others one or two per cent. of voids could be disastrous. This was a difficult problem to investigate experimentally and to answer on a quantitative basis, but he thought it important that attempts should be made and he would like to know what the industry thought were the most urgent problems for investigation in that field.

MR. LOGAN, speaking as one who had long advocated that the Institute should develop more time and attention to non-ferrous founding and particularly the light alloys, expressed his appreciation that this session on light alloys had been arranged at the Annual Conference. There was an interesting array of aluminium castings before them, and looking at them, he thought that even this limited display would make some of the cast-iron founders sit up and take notice.

By virtue of their superior properties in several respects, aluminium alloys were gradually encroaching on the ferrous field. During the first world war, aluminium pistons had replaced cast-iron pistons and the second world war greatly accelerated and extended the use of aluminium castings for many purposes. The period was particularly noteworthy for a great increase in gravity die-casting—which was now an important section of the industry. There was a large amount of castings now being used in the engineering and building industries in rivalry with cast iron and many different developments were proceeding. It was a feature they had to take note of. Among other examples, there was a complete die-cast sink unit described and illustrated in Mr. Martin's Paper. With the development of the new vitreous-enamel finishes which were now on the way, he saw no reason why the die-cast aluminium bath should not become a possibility in the near future.

The Paper by Mr. Caven and Mr. Keeble was an example of the Institute's motto—"Science hand in hand with labour." This particular team seemed to be a very happy combination, but possibly they were too modest as regards their achievements, for he thought it was safe to say that they had made the largest aluminium casting yet made in this country.

With regard to the Paper by Mr. Lees, from the practical point of view he supported all he had said so far as the control of hot-tearing was concerned. The two main factors were, undoubtedly, grain size and gas content. If, by grain refining, one controlled the grain size, then one had gone a long way to eliminate hot-tearing. As to the gas content, there was a good deal of misconception about that at the moment. A controlled, correct gas content would, he believed, provide an additional aid in reducing hot tearing; but what *was* the correct gas content for a particular application? We glibly talked about a high gas content or a low gas content, but quantitatively, we did not really know what we were talking about. The question was one about which we knew very little and much further investigation was required.

Referring to Mr. Logan's remarks on gas contents, MR. KEEBLE said it was quite true that much remained to be established on the subject of gas contents and their effect on casting properties of aluminium alloys. However, he thought that the picture was not as bad as was painted. Dr. Ransley, of The British Aluminium Company, Limited, was able, by his vacuum-hot-extraction technique, to indicate gas contents of wrought- and cast-aluminium alloys to a reliable and reproducible degree. It could be stated that 0.7 ml. per 100 grms. was a high gas content, 0.35 ml. a medium content and less than 0.2 ml. was a low content.

MR. CAVEN, speaking of the origin of the tube runner, said that the idea developed during the pro-

Discussions on Aluminium Alloys

duction of cylinders which were cast vertically with a view to ensuring a clean casting skin after subsequent machining and polishing. Having the service conditions in mind, bottom pouring appeared very desirable. The problem was, therefore, how to arrange a downgate approximately 5 ft. long which would make possible bottom running free from turbulence and, at the same time, would not endanger the casting by hot spotting at the ingates and thereby cause porous patches locally. After certain experiments, it was found that two ⅜-in. dia. tubes would run the casting and meet the required conditions, provided the downgate shaft was of the order of 4 in. dia. with a cavity at the base to trap the first splash of metal when pouring commenced.

The knowledge gained was next tried out on large diesel pistons and the method quickly developed on the lines detailed in the Paper. The advantages claimed for this arrangement of gates are:—(1) Controlled rate of pouring with minimum turbulence; (2) little danger of hot spotting at ingates, because the incoming metal tended to rise up the 4-in. dia. shaft rather than pass through the relatively narrow ingate channel; and (3) progressive solidification from the bottom of the casting to the feeder head—this was due to the metal in the 4-in. dia. shaft being hotter than the metal in the mould proper, thereby permitting the incoming metal to rise up the 4-in. dia. shaft and enter the mould from near the top of the rising metal in the shaft.

Taking the piston as an example, it required approximately 900 lb. of metal to pour. The pouring time, using two ⅜-in. dia. tubes, was about 2 min., *i.e.*, a ⅜-in. dia. tube would pass metal of suitable pouring temperature at the rate of over 200 lb. per min. The loss in temperature at the feeding head after completion of pouring was from 30 to 40 deg. C.

THE CHAIRMAN, referring to Mr. Martin's Paper, commented on the large number of risers and said the differences between cast and fettled weights of certain of the castings were rather amazing to him, as one dealing mainly with iron castings.

MR. MARTIN replied that the examples the chairman had selected were all castings produced in DTD.300 alloy. This alloy has a greater freezing range than most and, consequently, feed metal was required, not so much to make good the bulk shrinkage contraction but rather to provide liquid metal to knit together the first-formed dendrites. If this were not done the casting would have a spongy structure. For this reason it was not uncommon for the risers to account for 50 to 70 per cent. of the "as-cast" weight. Apart from this, depending both on the alloy and the nature of the job, castings made in aluminium alloys would normally require more feeding than castings made in iron and a figure for risers of 40 to 50 per cent. of the "as-cast" weight would be a fair average.

MR. KEEBLE said that aluminium alloys were much more "hungry" than cast irons because of the great differences in the amounts of solidification shrinkage which occurred at the liquidus/solidus interval. For most aluminium alloys, this was around 7 per cent., whereas for grey cast irons it varied from nil to, say, 2 per cent. (according to the amount and character of the graphite content), and was about 3.5 per cent. for white cast irons. For this reason and the very high standard of internal soundness to which aluminium-alloy castings were produced, the ratio of the runner and riser weight to that of the casting was high.

MR. SKELTON asked Mr. Keeble why it was that organic chlorides had been used for de-gassing.

MR. KEEBLE replied that an organic chemical was used as a de-gasser because of its suitability for the circumstances involved and the degree of gas freeness sought. Chlorine was very effective as a de-gassing agent, but its use required the installation of appropriate ventilation equipment which was not always convenient. When making billets for subsequent working, it was usual to aim for as low a gas content as possible. In the casting world, in particular that of gravity die-castings, if, for a certain casting, adequate feed could be made available, then as low a gas content as was practicable was sought. On the other hand, if by reason of design or method of making, this was not achieved, then a gas content was sometimes used to break down and disperse localised shrinkage. By this means, a casting was obtained which was probably "serviceable" but which was not completely sound in the technical sense. With respect to the "standing" treatment mentioned in the Paper, it was agreed that this presupposed a favourable atmosphere. It should be noted that some alloys were more sensitive than others to the effect of gas contents. For instance, a gas content considered of little or no detriment in, say, DTD.424 alloy, would have a severe effect in alloys like DTD.300A and DTD.304.

MR. F. HOWITT said that it was not true that founders neither required nor used a lower level of gas content in their metal than was used by the manufacturers of wrought alloys. He considered that the gas content of the DTD.300 type alloy produced in their foundry was probably lower than that achieved by the billet founders.

He also considered there was a great deal of loose thinking around the subject of de-gassing. The process required that the gas in the metal should be swept out by a stream of gas into which it would diffuse, which did not react with the alloy and which also possessed a low molecular weight. This was not true of chlorine, either in the form of gas from a cylinder or generated as the result of the breakdown of hexachlorethane; nor was it true of the aluminium-chloride vapour which was automatically produced.

Mr. Howitt considered the action of chlorine to be that of a fluxing agent. It was effective in removing suspended oxides and other complexes which gave rise, on solidification of the alloy, to unsoundness frequently regarded as gas porosity. Its true de-gassing capacity was questionable. Nitrogen gas, on the other hand, although it was said to combine with aluminium at temperatures over 700 deg. C., had the advantage of a comparatively-low molecular weight. He considered that the application of nitrogen gas

(Continued at foot of page 607.)

Guide to Aluminium Founding—III

Melting Techniques for Aluminium Alloys

By A. W. Brace, A.I.M.

(*Continued from page* 545.)

Aluminium alloys have the same general characteristics when molten as the pure metal. They form a thin oxide film on the surface, which prevents any further appreciable oxidation unless it is accidentally broken. Alloys have the same tendency to a greater or less degree to absorb hydrogen from the furnace gases, which may give rise to foundry troubles. Modern furnace design has eliminated most of the possibility of absorption, but, when using gas- or oil-fired furnaces, a slightly reducing atmosphere, *i.e.*, a flame tinged slightly luminous is most desirable. As with pure metals, overheating should be avoided; for some alloys temperatures over 760 deg. C. are harmful and, as a general rule, 800 deg. C. is the maximum any metal should attain even momentarily. Stewing must be avoided, since this can increase both the amount of oxide formed and the possibility of porosity due to gas absorption.

Fluxes

The use of fluxes in melting is a contentious question and there are varying schools of thought. Some operators maintain that the oxide film offers good protection of the metal and that fluxes are harmful to the life of the crucible.[1] In other cases it is claimed that an increase in grain size occurs as a result of their use. A third source claims that fluxes are extremely beneficial, and confer metal refinement, reduce gas content, and give the alloy superior physical properties.[2] To sum up, it is probably good general practice to melt without a flux and then add a small amount of flux just prior to pouring so as to remove the suspended oxide and impurities. Some alloys, particularly those liable to oxidation, appear to benefit more from flux refining. Fluxes may be used to improve the properties of aluminium silicon alloys by "modification," or, as in the case of AC.10, are essential to prevent oxidation. Proprietary compounds are usually quite efficient, but the compositions in Table I are given as being typical.[3] It should be emphasised, however, that fluxing cannot undo the harm done by bad melting practice and overheating.

TABLE I.—*Typical Flux Compositions.*

	(*a*) per cent.	(*b*) per cent.	(*c*) per cent.
Cryolite	15		
Sodium chloride	60	30	40
Potassium chloride ..	25	40	50
Calcium carbonate ..		15	
Sodium fluoride		15	10

Mechanism of Pinholing

Gas porosity has been found periodically to be a problem in some foundries. It reveals itself as small pinholes distributed throughout the whole of the casting, giving an unsightly appearance when the job is machined. These pinholes are unwelcome when the casting is for decorative purposes and show leaks if hydraulic pressures are subsequently applied. It is necessary briefly to consider the mechanism which causes the porosity. Aluminium alloys can absorb hydrogen right from the "pasty" stage, as indicated in the accompanying diagram, but the *amount* of hydrogen which they can dissolve is far higher at 800 than at 700 deg. C., for example. In general, the

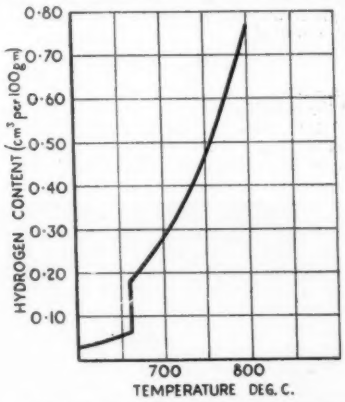

FIG. 1.—GRAPH OF SOLUBILITY OF HYDROGEN IN MOLTEN ALUMINIUM.

amount of gas that can be absorbed in a melt increases with temperature (Fig. 1).

When the metal is cast from 750 deg. C., it cools from this temperature to solidification point (about 640 deg. C.) in quite a short time. This reduction in temperature results in a lowering of the amount of gas that can be retained in the metal and consequently gas is released from it. Owing to the fact that the metal solidifies more quickly than the rate at which gas can escape to the atmosphere, tiny bubbles are entrapped, appear-

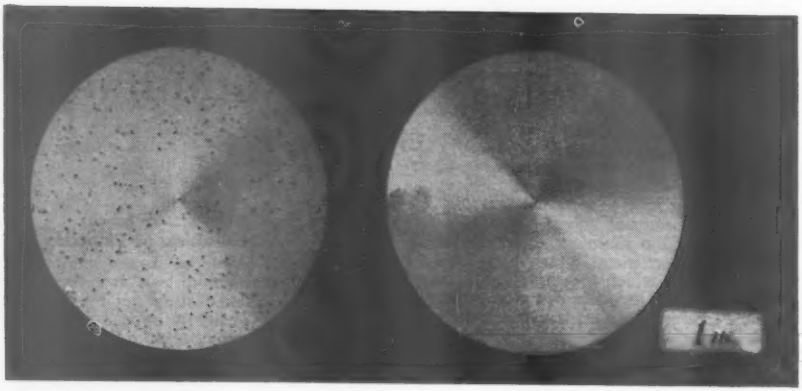

FIG. 2.—AN ALUMINIUM CASTING ALLOY SHOWING PINHOLE POROSITY AND THE EFFECT OF A DE-GASSING COMPOUND CONTAINING AN ORGANIC CHLORIDE. (*Courtesy—Foundry Services, Limited.*)

ing in the castings as pinholes. It will be observed that pinholing is more pronounced in the heavy sections, as would be expected.

Sources of Gas

Gas absorption can take place from (1) the furnace gases, (2) the crucibles and furnace tools, (3) from damp scrap, (4) the atmosphere, and (5) the mould. The absorption of gas from burning furnace fuels is very slight, where furnace design and operation is correct. Atmospheric absorption is a small but variable quantity; damp crucibles and tools are, however, not infrequent offenders. This source can be eliminated by thoroughly drying the crucible, both when new and before commencing each melting. Where metal is transferred from a large furnace into a small crucible for casting, the latter should be raised to a red heat before the transfer is made. When transferring metal it is important to bring the small crucible as near to the mouth or tapping-hole of the larger one as is possible, in order

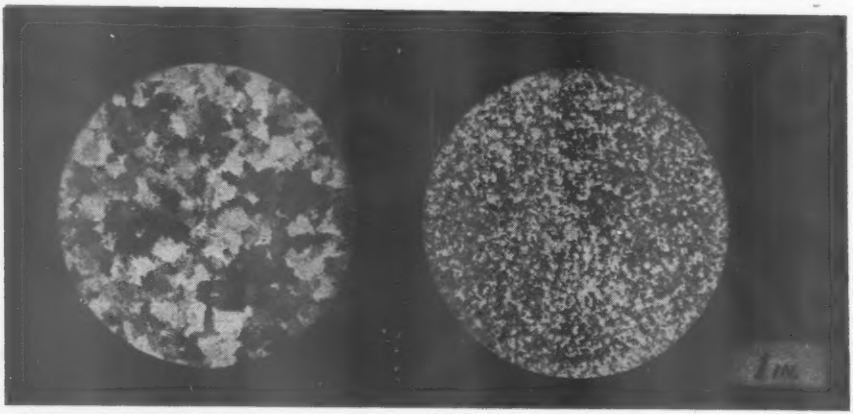

FIG. 3.—GRAIN REFINEMENT IN A CAST ALUMINIUM ALLOY (LEFT) BEFORE TREATMENT, (RIGHT) AFTER TREATMENT WITH A BORON COMPOUND. (*Courtesy—Foundry Services, Limited.*)

to avoid turbulence and consequent trapping of oxide in the metal. Gas from damp scrap can be avoided by ensuring good storage facilities; no water should be near the store, nor should it be possible for any to leak in. A slight draught of air through the store assists in keeping the metal dry.

Even with these precautions, at some time or other most aluminium foundries have encountered porosity due to gas absorption. It is not possible to make general statements about the behaviour of aluminium in this respect. Each alloy possesses its own characteristics. The alloy AC.1 does not pick up gas easily, neither do alloys containing magnesium as the major alloying constituent (AC.5 and 10), but some complex alloys such as "Y" alloy and R.R.50 are more susceptible to gas pick-up. There are on the market good proprietary de-gassing agents which are designed to remove dissolved gas. It has been suggested that they depend for their action on the decomposition of compounds to produce chlorine which may react with the dissolved hydrogen to form hydrochloric acid gas, this being insoluble in aluminium. There has been some disagreement with this suggested mechanism, it being argued that the main effect of the evolved chlorine is to produce large bubbles which remove the dissolved hydrogen by diffusion due to pressure differences between the chlorine bubbles and the hydrogen (Fig. 2). Nitrogen can also effect gas removal.

A Paper on control of gas in aluminium alloys[3] quoted experience in a production foundry where it was found that the continued application of chlorine-generating degasser ultimately produced in castings severe cavitation which possessed the characteristics of shrinkage. It is known that all aluminium alloys when solid have a small amount of hydrogen dissolved in them, probably in solid solution. The removal of the last residuum of hydrogen appears to produce very high shrinkage in the metal. To the practical foundryman this means that if de-gassing is applied any longer than is necessary to remove excessive gas, there is a great danger of shrinkage cavities appearing.

Control of De-gassing

It would, therefore, appear advisable to exercise some control over the use of gas-removing agents. For the small foundry, the following procedure is recommended. Each day, a small test cylinder about 1¼-in. dia. by 2 in. long is cast into a dried-sand mould and allowed to solidify. The block is then sectioned and lightly machined so as to give a very high-quality surface finish. In the normal way, when melting under good conditions, the block will be sound, but eventually small pinholes fairly evenly distributed will appear throughout the section. This is due to a gradual absorption of gas by the metal in circulation. De-gassing should then begin and continue until it can be reckoned that all scrap in circulation has been treated. This process usually takes one or two days. It is not advisable to continue de-gassing any longer than is necessary. Foundries with a metallurgist on the staff will be able to operate this system more efficiently, since microscopic examination is more discriminating than usual. This system has the advantage that it is simple to operate and does not interfere with production.

Conclusions

To summarise, it has been found that aluminium alloys raise no outstanding problems in melting. Equipment used for the purpose will depend upon local conditions and economics. The availability and cost of different fuels are important factors and, also, the amount of metal required at any one time affects the issue. Refractories present few problems and furnace repairs are needed infrequently. Care should be paid to details of cleanliness and furnace operation. Aluminium alloys should not be overheated or stewed, otherwise the material will be irreparably damaged. Fluxes are useful for refining some alloys (Fig. 3), especially those prone to oxidation or where large amounts of low-grade foundry scrap have been used. Gas porosity in aluminium alloys has given rise to several problems, but good furnace design, care in melting and judicious use of efficient de-gassing agents can eliminate this trouble.

REFERENCES

1 "Effect of Melting Conditions on Light Alloys," Murphy, Payne and Wells, *Proc. Inst. of British Foundrymen*, Vol. XXXII, 1938-9, pp. 133-140.
2 "Melting Fluxes for Aluminium," *Light Metals*, 1946, IX, 105, 525-8.
3 "Aluminium Alloys," Zeerleeder. High Duty Alloys edition, pp. 80-82.
4 "Method of Improving Properties of Aluminium Alloy Casting," S. L. Archbutt, *J. Inst. Metals*, 1925, 33, 227-252.
5 "System of Control for Aluminium Foundries," Allen, Morgan and Brace, *Light Metals*, 1943, 6, 222.
6 "Remelting Aluminium Alloys," Yves Dardel, *Met. Ind.*, 1948, 73 (1), 3-5.

Discussions on Aluminium Alloys

(*Continued from page* 604.)

produced a true de-gassing effect, and resulted in a residual gas content of a very low order.

The CHAIRMAN proposed a very hearty vote of thanks to each of the Authors of the Papers, both on account of the excellent work thay had done and for the clear and lucid way in which they had given their replies to the many and varied questions which had been put to them. He asked that all present should take the opportunity of inspecting the beautiful specimens of aluminium-alloy castings which were exhibited on the table in front of the platform. They were remarkable, and he had much admiration for those who had made them. The Papers, he believed, would be found of great value for reference purposes.

The vote of thanks was formally seconded by MR. A. TIPPER.

The Authors in turn each returned thanks, Mr. Keeble remarking that they were more than recompensed for the trouble they had taken in preparing the Papers by the great reception which their work had been accorded.

News in Brief

T. S. FOSTER & SONS, LIMITED, forgemasters, of Sunderland, have recently celebrated their diamond jubilee.

FIFTY YEARS AGO to-day Queen Victoria granted a Royal Charter to the Iron and Steel Institute. The president at that time was Sir William Roberts-Austen.

PRINCE METAL WORKS COMPANY, LIMITED, has taken over the Workington factory of Corner & Company, gas-stove manufacturers, for the manufacture of hollow-ware. Production will begin at the end of the year.

EMPLOYEES OF Bristol Steel Services, Limited, have volunteered to work 47 hrs. a week instead of 44, without extra pay. The managing director of the company, Mr. V. W. Burrough, has stated that the whole of the saving in wages would go towards reducing the cost of the company's products. The five-day week would be continued.

LARGE-SCALE DEVELOPMENTS, involving an expenditure of about £500,000, are planned at the Wolverhampton works of Joseph Sankey & Sons, Limited, steel-sheet manufacturers. They include new research laboratories, costing about £100,000, which will serve all the 60 works of Guest, Keen & Nettlefolds, Limited, of which Joseph Sankey & Sons, Limited, is a subsidiary.

WORK HAS BEGUN on a major extension to the Pallion (Sunderland) works of William Doxford & Sons, Limited, costing about £30,000, which will provide accommodation for a new drawing office and for engineering and technical staff. It will be used for detailed research and experiment into the Doxford opposed-piston oil engine, a need which has developed with the continued increasing popularity of this type of propelling machinery.

SPEAKING ON FOUNDRY TRAINING at Sheffield University Applied Science Department recently, Mr. A. E. Hoyland, of Edgar Allen & Company, Limited, stressed the urgent need for attracting recruits to the industry. He urged closer co-operation between unions and employers in training apprentices. Unions, he said, should lay down some standard which young men must reach before qualifying to hold a membership card, so that employers would know the card meant its holder could do a skilled job in any shop—iron, steel, or phosphor bronze.

AT A LECTURE given on November 7 to members of the Halifax Section of the Institution of Production Engineers, Mr. G. W. Nicholls, the president of the West Riding of Yorkshire Branch of the Institute of British Foundrymen, spoke on "Efficient Production Methods Applied to Iron Founding." Mr. Nicholls dealt with the development in modern foundry practices as applied to castings for machine tools. He showed the increased production possible by mechanisation in foundries, from the use of moulding machines, mechanical handling of sand, the latest development in charging, and in the fettling shop by the hydro-blast process.

Grey-iron Jobbing Founders to visit U.S.A.

Under the ægis of the National Ironfounding Employers' Federation, the Ironfounders' National Confederation and the Engineering and Allied Employers' National Federation, the grey-iron jobbing foundry industry is in process of selecting a team to visit America. The visit is being undertaken within the scheme evolved by the Anglo-American Council of Productivity. A letter has been sent out to as many ironfoundries as possible, but as some firms may have inadvertently been missed, such concerns should write to Mr. G. B. Judd, at 8, Frederick's Place, London, E.C.2, asking for details. The selection of candidates for a team of this type is not easy, because no individual can get the best out of a trip abroad, unless he is familiar with conditions in his own country. The composition of these teams is now sufficiently well known that detail should be unnecessary beyond stating that it comprises people representing supervision, technology, and craftsmanship, plus a secretary. There is some urgency in the selection of this team, and the last day for receiving nominations has been fixed for the first post of Saturday, November 26. It should be borne in mind that this is a team of *jobbing* founders and specifically *excludes* malleable, automobile, builders' and domestic castings, cast-iron pipes and the like. Members of large and small firms are equally acceptable. The costs, which are to be heavily subsidised, are clearly set out in the letter to which we have referred. It is now the occasion for the jobbing founders to lend their enthusiastic support and emulate the steel founders, whose courageous report has won such general approbation.

Buyers' Market for European Steel

Prospects Discussed in I.L.O. Report

A report prepared for the session of the I.L.O. Iron and Steel Committee due to begin in Geneva on November 22 points out that, as the abnormal demand for steel arising out of the war has largely been met, the European steel industry is now facing a buyers' market. For the future, the industry must rely on the normal demand for steel, with "little further support from the arrears of unsatisfied demand." The growth in the population, rising standards of living, and other factors indicate a vast latent demand for steel, the report states, but adds that this may not become an effective demand "unless high levels of income and employment in general are maintained."

A warning is given of the danger that high steel prices will almost certainly constitute a greater deterrent to steel purchases in the future than in the recent past. The drop in steel exports is attributed to the tightness of money and exchange difficulties, although no evidence has been found, it is stated, that export markets are saturated. It is thought that new demand may appear if these two obstacles can be wholly or partly removed.

British Cast Iron Research Association

Annual General Meeting

The Annual General Meeting of the British Cast Iron Research Association was held in the Waldorf Hotel, Aldwych, London, W.C.2, on November 2, 1949, the President, Mr. P. H. Wilson, O.B.E., M.I.Mech.E., in the chair. The minutes of the previous Annual General Meeting, held on November 3, 1948, were taken as read and were confirmed and signed.

Report and Accounts

THE PRESIDENT, presenting the twenty-eighth Annual Report and the accounts for the year ended June 30, 1949, which had been circulated, did not review them at length. The year under review, he said, was the first since the change that was made possible by the arrangement with the Joint Iron Council, and it would be noted that the increase in total income as compared with the previous year was of the order of £30,000, some £22,000 of that being increased industrial income, and the balance being increased grant. Running expenditure had increased by between £9,000 and £10,000. and included provision for the staff superannuation scheme which came into operation on October 1, 1948, and which was very much appreciated.

Apart from that, the increase in expenditure was accounted for. mainly, by extensions with respect to the research and development programme. The Association had also spent £15,000 on capital equipment and was committed to something like £25,000 to complete the scheme in progress. Therefore, a somewhat similar balance in hand would be required next year to meet those capital charges. That, however, would complete the Council's short-term scheme, which had involved the provision at headquarters of a new machine- and instrument-shop, a mechanical-testing laboratory and staff dining-room and cloakrooms, together with the transfer and almost complete replacement of the Association's Scottish laboratory, now at Glasgow. It was hoped the present building operations would be completed by the end of the current year, and that in the Spring or early Summer of 1950 it would be possible to resume the members' annual visits, which had been so popular in the past.

Operational Team

A long-term policy required to deal with the remainder of the Association's requirements within the foreseeable future was being considered, but how the capital required for that scheme was to be provided had yet to be settled. In the meantime, by arrangement with the Joint Iron Council, the Association was proposing to set up a team for the purpose of visiting member-foundries, with their approval and at their invitation, in order to see what was required to bring them up to the highest level of productive efficiency. A small committee of the Council was at present interviewing likely applicants for the team, which was called an operational research team, because its business would be to provide the foundry executives concerned with up-to-date information on which future executive decisions might be based. The Council had approved of the scheme in the firm conviction that the Association, along with many others, required to do very much more than it had been able to do in the past to bring home to member-firms the steps that were needed to make practical use in industry of the information, experience and knowledge, not only derived from its own experimental work, but also that which came to it from a multitude of other sources. That was a very important point.

French Activities

So far as the long-term plan was concerned, the Council had always been conscious of the fact that. to do the work needed by the industry, the Association should have an income of at least £100,000 per annum, and a staff of something like 180; and in the current Report it was hinted that the change in the value of money might make the ultimate income required nearly £150,000. What he had already stated about the expansion of advisory and development work, and certain other considerations, led him to wonder whether even now they were thinking on much too small a scale. The Director, who had recently been in France, had reinforced that opinion by indicating the developments proceeding there, where the technical centre for the foundry industry already employed a staff bigger than that of the B.C.I.R.A., and, in addition, had about eight active regional laboratories for the purpose of assisting day-to-day production control. The French industry was nothing like so large as our own, and yet it was planning on a larger scale.

Looking at the position from another angle, he said the ironfounding industry in this country, with its present output, must have a turnover of the order of £100,000,000 or more per annum. If we included its related pig- and refined-iron sides and the provision of equipment and materials for the industry, the figure would be *much* higher. It was generally held that an industry should provide something like 1 per cent. of its turnover for research and development. Indeed, the French foundry research centre was sustained by a sales tax of ½ to 1 per cent. Assuming, conservatively, that the turnover of the industry in this country was £100,000,000 per annum, the 1 per cent. would provide £1,000,000; assuming further, again conservatively, that the proportion which could appropriately be expended by a co-operative research association was only one-fifth of that sum—the balance being expended inside the industry itself—the figure of £200,000 was arrived at, which would sustain a staff of about

B.C.I.R.A. Annual General Meeting

350, including the provision of a series of related regional laboratories in the great industrial centres. So far as regional laboratories were concerned, the lines along which laboratory equipment and techniques were developing indicated the use of very costly apparatus, requiring skilled control, but relatively unskilled operation which yielded results very very quickly. Those considerations, combined with present-day rapid communication over an area, certainly suggested that a large number of producing foundries could obtain their daily control results from laboratories established, staffed and equipped on a regional basis.

Regional Laboratories for Day-to-day Control

It was said that two-thirds of the foundries in this country employed 50 or less persons. Therefore, perhaps such an arrangement as was suggested would be beneficial to those smaller foundries in respect of scientific control which they were not able to provide for themselves. The Association had provided an illustration of the application of that principle for many years in its Scottish laboratory; and it would be a comparatively easy matter to determine the location of five or six others to meet the requirements of the industry. While his remarks might appear speculative, the President asked that they should be regarded as indicative of the lines along which the Association was thinking, subject always to the problem which was eternally before the Council—how to find the capital cost.

Those views, he added, were his own, but he respectfully submitted them to the Council for consideration in connection with further developments. It was their desire to sustain a proper and suitable research programme and to see that the results were placed before member-founders in simple, understandable terms, and in the most explicit way. In order to do that, the Association needed the active co-operation of the best men in the industry, and he was sure that all members of Council and committees would join with him in appealing to all in the industry who would like to assist in fostering the work to get into touch with the Director of the Association. There were many new members under the new scheme who were not known personally to the Council and Director, and one would not like modesty on anybody's part to allow any new member to continue hiding his light under a bushel.

On behalf of the Council and the members of the Association. the President expressed very sincere appreciation of the work that had been done during the past year by the Director, Dr. Pearce, and the whole of his staff. They had been extremely busy, particularly with the developments which had taken place during 1948 and 1949; they were very heavily taxed, for one felt that the Association was under-staffed. The Council and members wished to express thanks for the excellent results obtained.

The President formally proposed:—

That the Report of the Council.* duty circulated, and accounts as audited and certified by the Association's Auditors, and now before the meeting, showing the position of the Association's affairs as at June 30, 1949, be approved and adopted.

* Abstract printed in our issue, November 3, 1949.

Research Activities

DR. J. E. HURST, J.P. (Vice-president, Chairman of Council), seconding the adoption of the Report, commented on the activities of the Council and its committees. Those activities were dealt with adequately in the Report, but he felt that in addition the members would appreciate a few words on the work of the past year, which was the first year of activities under what might be termed "the new look" in the Association.

The work that had been done in the Association's laboratories on nodular cast iron had rightly been given first place in the record of activities. The Report gave full details of the reception which was given to the announcement last year of that remarkable work. The discoveries made were the result of very elegant research work on the part of the research staff; and Dr. Hurst added his tribute to that paid by the President. Perhaps it would not be invidious, he said, to make special reference to Mr. Morrogh. whose brilliant work, extending over many years, had resulted in the development of the nodular-iron process.

All would be aware that since the announcement of the process, which was based on the use of cerium, further work had been done and other processes were being developed, or at least one other process had been developed, based on the use of magnesium. It was well known that that process was handled by the Mond Nickel Company, Limited, whose parent company, the International Nickel Company of Canada, had been responsible for evolving the magnesium process. The Mond Nickel Company was an old and valued member and supporter of the activities of the Association, and had co-operated almost from its inception.

The Commercial Development of Nodular Cast Iron

It was not necessary to assure the meeting that the whole subject of nodular iron, whether it be by the cerium process or the magnesium process, or indeed any other process which produced an iron of the same characteristics, opened the door to an entirely new chapter in the history of cast iron, a chapter which might materially affect the whole future of the cast-iron industry. The matter was receiving the Association's very close attention, both with respect to research and further developments. Dr. Hurst made it clear that, although the Association had evolved the cerium process, it wished to avoid any suggestion whatever that it looked upon the magnesium process as a rival. It was its duty as an Association, and its privilege as trustees for the industry, in matters of that kind, to be able to advise and recommend a process without regard to its origin, and it would do that with no other regard but that of scientific truth and, of course, the interests of the members. The Association

believed itself to be in a position to advise members quite impartially with respect to any of the processes, whether involving the use of cerium or magnesium; although, where the question of manufacture was concerned, there might be commercial considerations, arising, for instance, out of patent rights, and the respective owners of such patent rights would have to be consulted. The Association would do its very utmost to advise the industry impartially.

Not only did the Association take the view that the developments were in the interests of industry, but the Mond Nickel Company took the same view; their object was identical in that respect—to do everything possible to develop the cast-iron industry in this country.

The Council of the Association and its committees, the Director and his staff, had their feet very firmly on the ground, and they had not viewed the nodular cast iron research work out of perspective in relation to all the other activities of the Association. The chairman of the research board and the research committees, and the chairman of the development committee, were very anxious that it should be made clear that those other activities of the Association were not suffering in any way from an undue proportion of attention being devoted to nodular iron. The Council's report dealt adequately with all that other work. As chairman of the Council, Dr. Hurst assured all members that work was going on in all the research departments into other aspects of cast-iron metallurgy, slag reactions, sands and refractories, and so on. The work on sands and refractories was still very important, and indeed, without adequate knowledge on that subject, even nodular iron might not be successful. Similarly, the development department was very active and was pursuing its work, as indicated by the details in the Report.

(The Report and Accounts were approved and adopted.)

Re-election of President

DR. HURST was honoured to propose the re-election of Mr. P. H. Wilson as President of the Association, and complimented him on the way in which he had steered the affairs of the Association through at least one year of its activities under the "new look" conditions. Mr. Wilson was so well known, he said, that no comments were needed concerning his qualifications for the presidency.

MR. F. SCOPES (Vice-president), who seconded with particular pleasure, said Mr. Wilson's heart had been in the work of the Association for many years; he continued to take a most active interest in it.

(Mr. Wilson was unanimously re-elected for a further year of office, in accordance with Article 23.)

THE PRESIDENT, thanking the members for the renewal of their confidence in him, said there was still great scope for the work of the Association in connection with the foundry industry, and he would continue to do all he possibly could to further the interests of the Association and of the foundry industry generally.

Vice-presidents

MR. T. MAKEMSON, M.B.E. (Member of Council), proposed the re-election of the vice-presidents, under Article 23. He commended the considerable service they had given the Association over many years, and said the Association looked forward to the further continuation of their work. In re-electing them the Association would help and honour itself, and he hoped the vice-presidents felt that the Association was honouring them.

The proposal was seconded by MR. COLIN GRESTY (Member of Council), and was carried with acclamation.

The Vice-presidents are:—Mr. P. A. Abernethy; Sir William Griffiths, D.Sc.; Dr. J. E. Hurst, J.P., D.Met.; and Mr. F. Scopes (President, Joint Iron Council).

Members of Council

On the motion of MR. V. C. FAULKNER, seconded by MR. R. S. DARBY, the following were re-elected:—Mr. W. J. Colton; Mr. R. S. M. Jeffrey; Mr. R. K. Nicholson; Mr. A. E. Peace; Mr. N. R. Rees; Mr. R. C. Shepherd; and Mr. L. F. Wright. Mr. J. F. Stanier, who was co-opted during the previous year, was also elected; and Mr. N. F. Newman was elected in succession to Mr. FitzHerbert Wright (resigned).

Auditors—MR. S. H. RUSSELL proposed that the Auditors, H. Overton, Salt & Company, Chartered Accountants, be remunerated in accordance with the Council's decision. The resolution was seconded by MR. H. FIELD, and was carried.

Vote of Thanks

On the motion of MR. J. W. GARDOM, seconded by MR. F. ARNOLD WILSON, the members accorded warm thanks to the Council and committees, and to all who had assisted the Association in an honorary way.

DR. HURST proposed that the warm thanks of the meeting be accorded the President for his able conduct of the proceedings and for his work through the year.

MR. R. K. NICHOLSON seconded, and the resolution was heartily acclaimed, the President briefly responding.

* * *

An Extraordinary General Meeting was to have been held to consider the Articles of Association, as affected by the regulations under the new Companies Act. But some legal points in connection with the interpretation of the articles remained to be dealt with; and on the motion of the President, seconded by Mr. R. L. Handley, the meeting was adjourned until a date to be fixed by the Council.

JOHN FOLKES (LYE FORGE), LIMITED, manufacturers of iron and steel forgings, of Stourbridge, will shortly celebrate its 250th anniversary. The Folkes family has had an unbroken association with the company since its inception.

Pig-iron and Steel Production in Great Britain

Summary of September Statistics

The following particulars of pig-iron and steel production in Great Britain have been extracted from the Statistical Bulletin for October, 1949, issued by the British Iron and Steel Federation. Table I gives the production of pig-iron and ferro-alloys in September, with the number of furnaces in blast; Table II, production of steel ingots and castings in September, and Table III, deliveries of finished steel. Table IV summarises steel-industry activities during the six months ended September.

TABLE I.—*Weekly Average Production of Pig-iron and Ferro-alloys during September, 1949.* (*Thousands of Tons.*)

District.	Furnaces in blast, 1.10.49	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derbyshire, Leics., Notts., Northants, and Essex	25	—	13.7	24.8	1.7	—	40.2
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire	6	—	6.9	—	—	1.4	8.3
Yorkshire (incl. Sheffield, excl. N.E. Coast)							
Lincolnshire	14	—	24.2	—	—	—	24.2
North-East Coast	23	7.6	36.6	0.5	—	1.4	46.1
Scotland	9	0.8	11.9	3.1	—	—	15.8
Staffs., Shrops., Worcs., and Warwick.	8	—	9.3	1.2	—	—	10.5
S. Wales and Monmouthshire	8	4.2	19.8	—	—	—	24.0
North-West Coast	7	16.0	—	0.2	—	—	16.2
otal	100	28.6	122.4	29.8	1.7	2.8	185.3
Augus ·,1949*	102	25.2	122.0	28.6	1.6	4.9	182.3
September, 1948*	101	27.4	121.6	26.8	1.9	3.2	180.9

TABLE III.—*Weekly Average Deliveries of Non-alloy and Alloy Finished Steel.* (*Thousands of Tons.*)

Product.	1947 (53 weeks).	1948.	1948. Sept.*	1949. August* (revised).	1949. Sept.
Non-alloy Steel:—					
Heavy rails and sleepers	7.6	8.9	10.5	7.8	11.1
Heavy and medium plates	31.6	36.2	39.3	36.3	41.1
Other heavy products	31.8	34.7	37.0	31.9	36.4
Lightrolled products§	52.9	59.5	62.8	42.3	48.7
Hot-rolled strip				14.3	18.0
Cold-rolled strip	4.6	4.7	5.2	4.6	5.0
Bright steel bars	4.8	6.0	6.4	4.9	5.7
Sheets, coated and uncoated	24.3	26.3	27.7	23.5	28.6
Tin, terne and blackplate	12.1	13.5	13.4	11.0	14.5
Tubes, pipes and fittings	13.5	15.1	16.3	15.9	19.8
Wire	10.8	12.8	14.1	14.8	16.2
Tyres, wheels and axles	3.5	3.9	4.4	4.1	3.9
Forgings	5.0	6.0	6.6	5.9	6.6
Castings	3.0	3.5	3.8	3.1	3.0
Total	205.5	231.1	247.5	220.4	258.6
Alloy Steel†:—					
Tubes and pipes	0.3	0.4	0.2	0.5	0.5
Bars, plates, sheets, strip and wire	3.7	4.7	5.3	3.9	4.2
Forgings	1.8	2.5	2.7	2.4	2.7
Castings	0.6	0.7	0.7	0.7	0.7
Total	6.4	8.3	8.9	7.5	8.1
Total U.K. production‡	211.9	239.4	256.4	227.9	266.7
Less intra-industry conversion	19.2	29.0	34.4	29.5	36.1
Net U.K. deliveries	192.7	210.4	222.0	198.4	230.6
Add imported finished steel	2.2	3.4	2.6	7.1	8.5
Total deliveries of finished steel	194.9	213.8	224.6	205.5	239.1

† Excludes high-speed steel. ‡ Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.
§ Excl. wire rods and alloy-steel bars, but incl. ferro-concrete bars.

TABLE II.—*Weekly Average Production of Steel Ingots and Castings, September, 1949.* (*Thousands of Tons.*)

District.	Open hearth. Acid.	Open hearth. Basic.	Bessemer.	Electric.	All other.	Total. Ingots.	Total. Castings.	Total ingots and castings.
Derby, Leics., Notts., Northants and Essex	—	—	10.3(Basic)	1.5	0.2	11.4	0.6	12.0
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire	2.0	22.8	—	1.2	0.4	25.5	0.9	26.4
Yorkshire (excl. N.E. Coast and Sheffield)								
Lincolnshire	—	28.5	—	—	0.1	28.4	0.2	28.6
North-East Coast	1.9	57.9	—	0.8	0.5	59.5	1.6	61.1
Scotland	4.0	40.3	—	1.5	0.7	44.8	1.7	46.5
Staffs., Shrops., Worcs. and Warwick	—	15.7	—	0.7	0.6	15.7	1.3	17.0
S. Wales and Monmouthshire	9.8	47.8	5.3(Basic)	0.8	0.1	63.4	0.4	63.8
Sheffield (incl. small quantity in Manchester)	9.3	24.4	—	7.8	0.7	40.4	1.8	42.2
North-West Coast	0.6	2.5	4.8 (Acid)	0.3	0.1	8.2	0.1	8.3
Total	27.6	239.9	20.4	14.6	3.4	297.3	8.6	305.9
August, 1949*	24.0	228.8	18.2	13.7	2.9	279.8	7.8	287.6
September, 1948*	30.3	229.0	19.5	14.4	3.6	288.4	8.4	296.8

*Five weeks.

(*Continued at foot of following page.*)

New Australian Foundry Journal

Carrying the title "The Australian Foundry Trade Journal," and displaying it in exactly the same manner as the FOUNDRY TRADE JOURNAL, a new monthly magazine was born in September in Sydney. The publishers have been so charming about the "pinching" of our heading layout that we just cannot protest. Under the heading, "Dedication," the Editor writes:—

"When Federation came to Australia in 1901 and an emblem of our nationhood was struck, against the background of our Southern Cross and forming part of our flag was the Union Jack—symbolic of our link with Great Britain and a testimony to her contributions towards our nationhood. During the two wars that have intervened and the periods between and after them, Great Britain has maintained and even increased her efforts in fostering our second stage of development, the establishment of industrial stability. In doing this she has sent us technicians and skilled tradesmen who, besides other things, pioneered our foundry industry. In hand with this, the FOUNDRY TRADE JOURNAL, regarded by us in Australia as almost an institution, has supplied the technical information necessary for its growth. We dedicate this Journal to the same ends that the British journal has achieved and incorporate in our cover acknowledgment of this."

This first, a souvenir issue, has articles on sand, electric melting, and the apprentice problem and some feature notes. A good beginning has been made and we congratulate the young Editor, who, we learn, is an ex-moulder, on his enterprise. The subscription has been fixed at 10s. (Australian) per annum, and the address is simply Box 5255, G.P.O., Sydney, the publishers being McCrone Publications.

Productivity Team Welcomed

In welcoming the specialist team on mechanical handling on its return from America on November 10, the director of the Institution of Production Engineers, Major C. B. Thorne, M.C., said that the Institution was vitally concerned in the adoption of methods which would not only increase output, but reduce the cost of the product, and would therefore place at the disposal of the team all available facilities to enable its findings to be disseminated as widely as possible.

West German Steel Scrap for U.K.

Exports of scrap steel from Western Germany in September totalled 211,000 tons (54,000 tons more than in the previous month) and brought total exports for the 12 months ended September 30 to 2,900,000 tons, according to a report circulated by the office of the Allied High Commission. It is stated that contracts for a total of 2,600,000 tons have been concluded up to October 15, with the United Kingdom taking the first claim (654,000 tons). The report says that prices vary considerably. For small lots they are as low as $17 per ton, while larger tonnages sell for as much as $23 to $29.

Since the requirement of earnest money has been eliminated, many contracts have been concluded by non-*bona-fide* buyers to serve only as a basis for an attempted resale to actual scrap steel users. It is apparent, the report says, that many of these contracts will not be implemented.

Steel Company of Wales Project

Mr. W. John Kenney, Minister in charge of the Marshall Aid Mission to the United Kingdom, on Wednesday saw preliminary construction at the Abbey Works of the Steel Company of Wales, Limited, at Port Talbot, which will employ machinery financed by Marshall aid. The Economic Co-operation Administration will finance about $27,000,000 worth of machinery and equipment for this development, which will be the largest amount of E.C.A.-financed machinery to be used in any single industrial project in Britain. The Steel Company of Wales will spend about £60,000,000 on the plant. E.C.A. will make the dollars available to the British Government to cover the machinery purchased in the United States and the company will pay the full purchase price in sterling. When it reaches full production in 1952, the company will turn out about 1,250,000 long tons of crude steel annually.

PERCENTAGE STATISTICS related to targets are usually meaningless to people outside their country of origin. However, some figures recently received from Hungary giving percentage increases over 1948 show that the smallest gain—9.6 per cent.—was made by the foundry industry.

PIG-IRON AND STEEL PRODUCTION IN GREAT BRITAIN (*Continued from previous page*).

TABLE IV.—*General Summary of Pig-iron and Steel Production.* (*Weekly Average in Thousands of Tons.*)

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy).			
						Imports.†	Output of ingots and castings.	Deliveries of finished steel.	Stocks.‡
1938	228	89	—	130	118	16	200	—	—
1947 (53 weeks)	209	136	165	147	145	8	240	195	797
1948	252	172	200	178	174	8	286	214	1,028
1949—April	255	163	198	179	192	20	305	226	1,097
May	263	171	201	187	199	22	316	245	1,121
June*	268	168	202	186	188	28	301	236	1,177
July	258	164	194	177	152	21	244	198	1,238
August*	248	172	196	182	179	21	288	205	1,320§
September ..	266	177	199	185	194	19	306	239	1,334*p*

* Five weeks. † Weekly average of calendar month. ‡ Stocks at end of years and months shown. § Revised. *p* Provisional.

Company News

The paragraphs below have been extracted from statements circulated to shareholders, speeches made at annual meetings, and other announcements.

Whessoe, Limited, engineers, foundrymen, etc., of Darlington:—The company is raising £300,000 by a rights issue of 200,000 ordinary 5s. shares at 30s. a share to assist in meeting the cost of works reconstruction and to provide additional working capital. It is further proposed to double the increased ordinary share capital to £500,000 by a bonus issue of a further 1 million ordinary 5s. shares by capitalising the premium of 25s. a share on the issue of the 200,000 ordinary shares. Treasury consent has been obtained.

Metal Traders, Limited:—The directors state that their intention to seek authority for a capital bonus will have to be deferred for the time being consequent upon the Chancellor's recent announcement suspending capitalisation of companies' reserve funds. The proposed bonus was of nine £1 shares to every holder of £1 of stock and would have reinstated the nominal capital of the company to the figure ruling before the return of 18s. in the £ to stockholders in 1940.

Thos. W. Ward, Limited:—An extra-ordinary meeting is to be held on November 25 to consider a resolution adopting new articles under which *inter alia* the dividends on the first and second preference are to be paid half-yearly on January 1 and July 1 in each year instead of quarterly on January 1, April 1, July 1, and October 1, as hitherto.

Peglers, Limited, brassfounders, etc., of Doncaster:—Treasury sanction has been obtained for the company's proposed bonus issue. It is proposed to capitalise £251,043 from general reserve and to allot new 5s. "A" and "B" ordinary shares to existing holders respectively, the ratio of allotment in each case being three for two.

Company Results

(Figures for previous year in brackets.)

SHOTTS IRON COMPANY—Dividend of 5% (same).

CANNON IRON FOUNDRIES—Final dividend of 10%, making 15% (same).

GUEST, KEEN & NETTLEFOLDS—Interim dividend of 4% (same) on increased capital.

THOS. GOLDSWORTHY & SONS—Trading profit for the year to June 30, £79,607 (£65,496); to depreciation, £6,000 (£4,500); taxation, £30,060 (£21,445); National Defence Contribution, £32 (nil); directors' emoluments, £6,168 (£5,485); auditors, £210 (same); net profit, £37,137 (£33,856); taxation reserve not required, £22,853 (£12,218); brought in, £1,701 (£15,001); available balance, £61,691 (£61,075); to appropriations re 1947 accounts, nil (£11,094); dividend of 7% (same); general reserve, £15,000 (£12,393); taxation reserve, £30,000 (£22,000); forward, £2,804.

THOMPSON BROS. (BILSTON)—Balance of trading profit to July 31, £240,728 (£163,006); investments income, nil (£413); from reserve for contingencies, £3,500 (£2,000); E.P.T. relief, nil (£1,262); to directors' remuneration, £23,811 (£20,298); staff pension scheme, £5,671 (nil); audit fee, £400 (same); depreciation, £21,007 (£13,477); for contingent liability, £5,000 (nil); taxation, £97,500 (£70,500); leaving £90,838 (£62,003); expenses of bonus issue, £1,577 (nil); final dividend of 6¼% (7½%) and bonus of 5% (10%), making 18¾% (25%) on increased stock; employees' benevolent fund, nil (£2,000); general reserve, £50,000 (£35,000); forward, £50,616 (£31,692).

METAL TRADERS—Consolidated trading profits for the year to March 31, £226,760 (£288,020); to directors' emoluments, £36,011 (£36,867); audit, £1,607 (£1,406); depreciation, £3,842 (£9,413); taxation, £94,341 (£133,649); income from investments, £496 (£1,183); surplus on realisation of assets, £636 (£1,583); loss on foreign currency recovered, £559 (nil); credits no longer required, nil (£300); war damage commission, £737 (nil); interest of outside shareholders in subsidiaries, £1,471 (£5,517); consolidated net profit, £91,916 (£104,234); subsidiaries' profits, £42,303 (£44,568); net profit, £49,613 (£59,666); to dividend of 4s. (5s.) per unit of stock, £45,733 (£57,167); forward, £133,871 (£129,991).

COCHRAN & COMPANY, ANNAN—Trading balance to June 30, £154,604 (£144,232); interest, £134 (£482); provisions no longer required, nil (£1,456); to depreciation of freehold land and house property, £425 (£287); off alterations and improvements, £950 (£2,991); depreciation of works buildings, plant, etc., £11,968 (£11,556); off special expenditure, £2,149 (£2,955); directors' remuneration, £15,177 (£13,245); auditors' remuneration, etc., £315 (£340); excess expenditure property revenue account, £1,707 (£1,076); doubtful debts provision, nil (£1,000); profits tax, £16,673 (£15,500); income tax, £48,747 (£46,239); credit tax adjustments, £1,685 (£1,162); net profit, £58,312 (£48,855); to general reserves, £35,000 (£25,000); retirement benefits, £5,000 (£10,000); final dividend of 7½% (5%), making 9% (6¾%); forward, £10,301 (£6,864).

DOWTY EQUIPMENT—Consolidated trading profit to March 31, £179,353 (£93,343); to stock reserve, £32,003 (£24,813); depreciation, £25,885 (£26,129); off formation expenses, £342 (nil); audit fees, £2,830 (£2,604); directors' emoluments, £17,315 (£20,287); leaving £78,375 (£73,833); investments income, £7,500 (£12,843); interest, £72 (£3,256); provisions now credited and non-recurring receipts of a foreign subsidiary, £64,675 (£10,598); miscellaneous, £2,286 (nil); attributable to outside holders in a subsidiary, £1,306 (£12,572 loss); parent company's profit, £140,820 (£122,640); written off investment in foreign subsidiary, £214 (nil); provision for loss incurred by subsidiary, £7,533 (nil); profits tax, £22,000 (£18,000); income tax, £51,000 (£47,000); final dividend of 3% (same) on increased capital, making 13⅓%, tax free (same); forward, £179,726 (£147,153).

ARTHUR LEE & SONS—Consolidated profit and loss account for the year ended July 31 shows balance, £621,774 (£630,476); to depreciation, £75,120 (£65,656); auditors' remuneration, £526 (£476); directors' emoluments, etc., £47,876 (£48,422); trade investments income, £8,824 (£7,645); other investments income, £4,425 (£3,972); to tax, £285,842 (£277,014); attributable to outside shareholders, £1,480 (£903); net profit, £224,179 (£249,622); retained by subsidiary companies, £63,618 (£2,693); net profit of Arthur Lee & Sons, £160,561 (£246,929); brought in, £75,309 (£67,298); sale of investment, £21,333 (nil); deferred repairs no longer required, £13,288 (nil); taxation over-provided, £16,442 (£2,715); to general reserve, £120,000 (£150,000); plant obsolescence reserve, nil (£15,000); superannuation and retiring reserve fund, £537 (£5,668); investments reserve, £21,333 (nil); final dividend of 30%, making 45% (same); forward, £74,097.

THOS. W. WARD—Group accounts for the year to June 30 show parent's trading profit, £855,570 (£972,883); subsidiaries' trading profit, £807,508 (£681,804); group trading total, £1,663,078 (£1,654,687); group investment income, £40,246 (£27,544); tax over-provision, £6,367 (£15,350); reserves freed, nil (£57,500); profit on sale of fixed assets, £11,856 (£73,085); dividends from pre-consolidation profits, nil (£66,379); group's total income, £1,721,547 (£1,894,645); to depreciation on fixed assets, £183,631 (£190,940); interest, £1,079 (£1,328); audit, £3,582 (£2,770); profits tax, £224,525 (£230,150); income tax, £600,050 (£624,576); off development, nil (£900); cost of initiating pension scheme, £16,766 (£81,474); benevolent scheme, £27,500 (£28,000); available income, £664,414 (£734,507); to additional depreciation on fixed assets, £53,004 (nil); replacement of fixed assets, £11,000 (£63,000); general reserve, £52,500 (£16,500); future taxation, nil (£42,389); available for disposal, £547,910 (£612,618); to minority interests, £41,419 (£37,246); to parent company, £113,855 (£106,333); retained by subsidiaries, £102,727 (£38,376); parent company's profit, £403,764 (£536,996); sundry income, £411; brought in, £309,179; dividend on first preference, £13,750; on second preference, £25,000; on employees' shares, £4,575; final ordinary dividend of 10%, making 15% (same); final dividend of 3⅓% on employees' shares, making 3⅓% tax free; to general reserve, £100,000; forward, £476,881.

STANTON-DALE

REFINED PIG IRON

Designed to meet the demands of high quality castings, which are, strength, machineability, and resistance to wear.

All these can be secured by using Stanton-Dale Refined Pig Iron in your cupolas.

The above illustration shows a group of castings made by Messrs. Goodbrand & Co. Ltd., Stalybridge, Cheshire.

PROMPT DELIVERY

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

Obituary

MR. HENRY DECK, a director of Ransomes, Sims & Jefferies, Limited, Ipswich, died on November 8 after a very short illness. Early in his 55 years with the firm his abilities on the sales side were recognised and he was appointed sales manager at the end of the 1914-18 war. In 1929 he was appointed to the board and retained active participation in the business up to his death.

THE DEATH is announced of Mr. Frank Marsden, chairman and managing director of Joseph Stubbs, Limited, textile engineers, of Manchester. He died last Friday at his home in Hale. Mr. Marsden was a practical foundryman, who rose step by step to reach the chairmanship of his company. He was recognised as an expert in the production of high-silicon cast iron, and an article which he wrote for the FOUNDRY TRADE JOURNAL during the war was recognised as being most helpful in aiding the expansion of this important production. He joined the Institute of British Foundrymen in 1939, and was a keen supporter of the Lancashire Branch. His progress in the industry constitutes a fine example of the opportunities offered to foundrymen who are prepared to work hard and assume responsibility.

WE REGRET to announce the death of Mr. J. Davenport, which took place last Saturday. Mr. Davenport was foundry manager to Hopkinsons, Limited, of Huddersfield. Before joining this firm he held a similar position at the Leyland Works of Leyland Motors, Limited. Still earlier he was with Thwaites Bros., Limited, of Bradford. "Jim," as he was known to a wide circle of friends, joined the Institute of British Foundrymen in 1926. He was a real pioneer in foundry practice, as he was making "electric" steel during the 1914 war and carried out much experimental work on the centrifugal casting of steel. In the foundry at Hopkinsons he sponsored a number of worthwhile innovations. He was of a rather retiring disposition, but could express himself vigorously on subjects which interested him. He possessed much dry humour which he used effectively in the management of the shops he controlled. He had a record of success in every position he occupied and those who were privileged to serve with him will long mourn the loss of a sympathetic leader and an exceptionally competent foundryman.

Increases of Capital

Details of increased capital have been announced by the following companies:—

MARSHALL CASTINGS, LIMITED, Birmingham, increased by £20,000, in £1 ordinary shares, beyond the registered capital of £30,000.

FRY'S DIECASTINGS, LIMITED, Merton Abbey, London, S.W.19, increased by £100,000, in £1 ordinary shares, beyond the registered capital of £100,000.

HAYWARD TYLER & COMPANY, LIMITED, ironfounders, engineers, etc., of Luton, increased by £50,000, in £1 ordinary shares, beyond the registered capital of £215,000.

CLEVELAND MAGNESITE & REFRACTORY COMPANY, LIMITED, Normanby, Middlesbrough, increased by £50,000, in £1 shares, beyond the registered capital of £10,000.

Scottish Foundryman Honoured

Mr. T. R. Goodwin, Bonnybridge, honorary secretary of the Falkirk Section of the Scottish Branch of the Institute of British Foundrymen, has been appointed by his firm, Smith & Wellstood, Limited, Bonnybridge, to an important position in their South African works, and in consequence has had to resign his secretaryship, which he has held since 1938. He was president of the Section during 1945-46.

At a function in Falkirk on November 10 he and Mrs. Goodwin were each presented with a cheque in the presence of a large gathering of members of the Institute. Mr. John C. Leith, president, was unable to be present, and Baillie Wm. Bulloch, junr., Denny, vice-president of the section, and member of the Scottish Branch Council, presided. The chairman said Mr. Goodwin was going to a post of considerable responsibility and they commended the admirable foresight of Smith & Wellstood in appointing him to look after their interests in South Africa. They congratulated Mr. Goodwin on his appointment.

Mr. R. S. M. Jeffrey, B.Sc., F.R.I.C., Kirkintilloch, president of the Scottish Branch, in handing over the cheques, said the Scottish Branch Council was losing a very valuable member whose work had always been highly appreciated.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

ALUMINIUM MELTING EQUIPMENT

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—We were interested in the article by Mr. A. W. Brace in your November 3 issue on "Melting Equipment in the Aluminium Founding Industry." Although Mr. Brace makes reference to induction furnaces as being, from many viewpoints, ideal, he describes these furnaces as having a "ring" below the melting chamber which must be filled with molten metal before melting can commence and must remain filled when the crucible is emptied.

We would like to draw your attention to the fact that the above limitation applies only to one type of induction furnace and that there are others available which have not this disadvantage. We refer, in particular, to the Efco-Lindberg two-chamber aluminium-melting furnace, in which the "ring" is replaced by inclined channels joining two chambers, one for charging and the other for ladling or pouring. All dross collects in the first chamber, leaving the metal in the second clean. The whole of the metal in the ladling chamber can be emptied, if required, though the furnace is primarily intended for continuous melting for the die-casting industry. If the metal is allowed to solidify, the furnace can easily be restarted by applying a gas torch to the surface of the metal in the two chambers.—Yours, etc.,

J. G. GAMAGE.

Electric Furnace Company,
Limited.

FOUNDRY FACINGS

SHALAGO BONDED BLACKING
MAKES A PERFECT BLACK WASH

GRAPHITE, PLUMBAGO, BLACK LEAD

NON-SILICA PARTING POWDER

CUMMINGSTONE
FOR MAKING PATTERN PLATES

CORE COMPOUNDS
SEMI-SOLIDS, CREAMS AND POWDER

TERRA FLAKE

COAL DUST
ALL GRADES

WM. CUMMING & CO. LTD.
GLASGOW, FALKIRK, CHESTERFIELD, BILSTON, MIDDLESBROUGH

CHAPLETS
ETC.

SAND MIXERS
75 AND 112 LBS. CAPACITY

ELECTRIC RIDDLES
WITH OR WITHOUT TRIPOD

JOLT MOULDING MACHINE

CUMMING COKE-FIRED FURNACES
80 TO 250 LBS. CAPACITY

HAND RAMMED MOULDING MACHINE

Raw Material Markets

Iron and Steel

Blast-furnace outputs barely keep abreast of current requirements. Some of the foundries are not so busy as they were in the first half of the year and to some extent the pressure for deliveries of pig-iron has eased. But the whole of the output of merchant iron is going promptly into consumption and conditions do not permit of any substantial additions to stock. Hematite supplies are readily absorbed and there is a steady demand for high-phosphorus iron. Refined irons are more freely available.

It has become less easy to negotiate new business in light re-rolled material, as most of the works now have good stocks of steel semis in hand and are not pressing for further deliveries. To this broad generalisation, however, there are some exceptions. Small 2-in. billets are still wanted and so are sheet bars and special quality steels. On the other hand, the larger sizes of billets, blooms, and slabs are plentiful; defectives are not readily saleable and, reflecting diminished interest, prices obtainable for re-rolling scrap have slumped.

Shipbuilders, boilermakers, and constructional engineers still have a huge volume of work in hand and the flow of specifications for plates, heavy joists, and sections exceeds the capacity of the heavy rolling mills. Rail mills, too, maintain unimpaired activity, while the advance of 32s. 6d. per ton which brings the price of galvanised sheets (24 gauge) up to £38 19s. 6d. would be willingly paid if buyers could be promised delivery within the next few months.

Non-ferrous Metals

In preparation for the reopening of the London Metal Exchange for trading in tin, the Minister of Supply issued an Order on Saturday freeing the metal from his control as from Tuesday. The market is now launched on its course, and consumers, instead of buying tin against licence from the Government, are placing their business with those houses, which in years gone by were purveyors of tin. The new venture is being watched anxiously and sympathetically by all in the metal trade for whom there is so much at stake. Everyone now is anxious to see the freedom accorded to tin passed on to copper, lead, and zinc.

Metal Exchange tin quotations were as follow:—

Cash—Tuesday, £725 to £726; Wednesday, £707 10s. to £712 10s.

Three Months—Tuesday, £660 to £669; Wednesday, £650 to £655.

Last Thursday the Ministry of Supply raised its selling limit for zinc by £2 to £87 10s. per ton, thus restoring the price to the level at which it was fixed when the pound was revalued. It will be remembered that within a few weeks of devaluation a cut of £6 was made, and now, following three advances of £2 each, the price is back where it started. Lead, on the other hand, last week closed rather weaker in America with a cut of 25 points in the current quotation. Cheap Continental brands are still arriving in the United States, and since current demand there is not too good, the domestic quotation has eased. Copper, however, has been decidedly firm under the influence of the excellent consumption figures for September (reported at 114,760 short tons, or 26,672 tons higher than August). Deliveries during last month are likely to be very good and higher than in September.

In Britain the scrap market has reflected this bullish sentiment, and during the second half of last week prices of both brass and copper were marked up substantially. Sectionally, there seems to be a shortage of certain types of scrap, perhaps because holders are awaiting a higher level of prices before they dispose of their material. But the overall scrap position is quite good, for the Ministry of Supply disposals section is holding large stocks, and is regularly issuing invitations to tender for 70/30 brass cases and fuse scrap.

Under an Order which came into force on Tuesday, the Minister of Supply has consolidated all previous Control of Non-ferrous Metals (copper, lead, and zinc) Orders, has freed from control the acquisition and disposal of copper and zinc scrap, and has revoked the old statutory maximum prices of copper, lead, and zinc. Although licences will no longer be required to acquire and dispose of scrap copper and zinc, they will still be needed for scrap lead owing to the rationing scheme, and for unwrought forms of the three metals.

Margins for copper rods have been altered, but the Minister records grateful co-operation of the manufacturers, and promises continued consultation with them. Margins for the following products will continue to be settled in conjunction with manufacturers:—Black hot-rolled copper wire rods, manufactured in the U.K., zinc sheets and boiler plates, and zinc oxide. At present these margins remain unchanged except in the case of black hot-rolled copper wire rods (not less than ¼ in. or more than ⅜ in. in diameter), where it has been agreed that the margin chargeable by the U.K. rod rollers may be increased from £6 per ton to £9 12s. 6d. per ton. In this case, where orders are booked for future delivery, the additional charges made by the Ministry on forward bookings of metal may be added.

To meet the position of stockists, who had asked the Ministry to adjust its extra charges for deliveries of small lots in order to take account of post-war increase in handling and labour costs, the Ministry has from Tuesday increased its list of extras (per ton) as below:—

	Copper.		Zinc and lead.	
	Old extra.	New extra.	Old extra.	New extra.
	£	£	£	£
Deliveries in lots over 2 tons and under 4 tons	2	3	1	2
Over 1 ton up to and including 2 tons	3	4½	1½	3
1 ton and under	4	6	2	4